NUTRITIVE VALUES OF WHOLE-ANIMAL DIETS FOR CAPTIVE BIRDS OF PREY

by
D. M. Bird
Macdonald Raptor Research Centre
Macdonald College, P.Q., Canada
and
S. K. Ho*
Department of Animal Science
Macdonald College, P.Q., Canada

*Present Address: Animal Research Institute, Agriculture Canada, Ottawa, Ontario, Canada, K1A 0C6.

Introduction

A recent upsurge in the number of birds of prey held for captive-breeding and rehabilitation purposes has led to a pressing need for information concerning their health requirements in captivity. Essential to their well-being is a reasonably sound diet. Although most falconers can supply one or two birds with fresh food obtained from the wild, larger aviaries usually must resort to domestic stock, fresh and/or frozen. Many questions have arisen, however, as to the nutritive values of the various food-types for captive birds of prey (see transcripts of 1971 and 1972 Raptor Research Foundation, Inc., conferences at Sioux Falls, South Dakota). The present study represents an attempt to obtain a partial analysis of the nutrient contents of some commonly used domestic animals.

Materials and Methods

Rats, mice, chickens, and two strains of day-old chicks were used in this study. Frozen whole carcasses were randomly selected, ground in a meat-grinder, freeze-dried, thoroughly mixed, and reground to a finer mesh for chemical analyses.

Nitrogen and crude fat contents of the samples were determined by the Kjeldahl method and the direct ether extraction method, respectively. Crude fiber is the loss on ignition of dried residue remaining after digestion of a sample with 1.25 percent sulfuric acid and 1.25 percent sodium hydroxide solutions. To obtain ash values the samples were left overnight in a muffle furnace at 600C. The details of these analytical techniques are described in *Official Methods of Analysis* (Association of Official Analytical Chemists 1980). Gross energy values were obtained by using a Parr Oxygen Bomb Calorimeter (Parr Instruments Company, Moline, Ill.).

To prepare for mineral determinations, the samples were digested with a mixture of nitric and perchloric acids (25:4, v/v). For the determination of calcium, the absorbance values of the diluted digest, containing 1 percent (w/v) of added lanthanum, were measured at 422.7 nanometers using an atomic absorption spectrophotometer. Total phosphorus values were determined on the diluted digest using molybdovanadate reagent as described by the Association of Official Analytical Chemists (1970). Trace mineral determinations (zinc, copper, manganese, and iron) were made on the nitric-perchloric acid digest (with appropriate dilutions, but without the addition of any reagents) by atomic absorption spectrophotometry at

213.9, 324.7, 279.5, and 248.3 nanometers, respectively. Distilled-deionized water was used throughout the mineral determinations.

Thiamine contents were measured (through the assistance of Hoffman-La Roche) by a gas chromatographic procedure modified after Seifert and Miller (1973).

Results and Discussion

Information on the nutritional needs of birds of prey is scarce, thereby making it difficult to draw conclusions on the partial analysis of the nutrient contents of some commonly used domestic animals as presented in table 1. No statistically significant differences are implied in the following discussion though an attempt is made to elaborate on several salient points.

Figures representing percent dry matter, crude fat, and crude protein (N x 6.25) show little variation among the species analyzed. Ash content, which reflects the general mineral content of the sample, is slightly lower in day-old chicks than in other species. As expected, crude fiber is much lower in chicks than in full-grown animals. This low content might be of some importance to birds of prey in terms of pellet casting, a habit which has yet to be proved physiologically necessary. Mendelssohn and Marder (1970) observed, however, that raptors fed only lean meat ingested other materials to form their pellets. It has also long been recognized by falconers that casting acts to swab out accumulated mucous in the digestive system and that pellets may serve as an index of health and well-being.

Gross energy contents reported here in all species are fairly constant and closely coincide with figures reported by Duke et al. (1973) for mice and day-old turkey poults, but are considerably greater than those reported by Graber (1962) for several species of mice.

Although dietary requirements for birds of prey may vary somewhat from those of poultry, certain desirable traits (e.g., feather growth and egg production) are likely controlled by the same nutritional factors in both avian groups. Hence, mineral and thiamine requirements of breeding hens, as recommended by National Academy of Sciences-National Research Council (1971), are presented in table 2. The recommended calcium level (particularly the Ca:P ratio) is much higher than that previously reported for birds of prey by Wallach and Flieg (1970). Since raptors, unlike poultry, are not expected to lay eggs on a continual basis, the requirements of 2 percent of the total diet recommended by the latter researchers is surely sufficient. The Ca:P ratio of 1.5:1 reported by them is in close agreement with the remarkably constant ratio shown for all species examined, in table 1.

With regard to trace elements, it is obvious that zinc and iron are adequate, copper could be marginal. If, however, the National Research Council suggestions for layers and breeders are to be used as a guide, some form of manganese supplementation of all four diets may be necessary because manganese deficiency has been implicated in fertility problems (Underwood 1971). In laying and breeding birds, for instance, manganese deficiency results in lowered egg production and hatchability, as well as in reduced eggshell strength.

Much controversy has surrounded the dietary value of day-old chicks (see transcripts of 1971 and 1972 Raptor Research Foundation, Inc., conferences at Sioux Falls, South Dakota). Because the nutritional makeup of day-old chicks could possibly vary with different sources, as a result of different feeding programs of the parent birds and other factors, chicks from two hatcheries were examined during this study. There are distinct differences–for example, in values for zinc and thiamine–in the two strains.

Low levels of calcium in day-old chicks have been discussed by Cooper (1975) though no figures were given, and radiological examination depending on methodology might not reveal sources of calcium in muscles and other tissues. It is apparent from table 1 that calcium is below the 2 percent level suggested by Wallach and Flieg (1970) for growing and laying birds of prey, and slightly more than half the values reported here for mice and rats. This situation

can be remedied, however, simply by tearing open the abdominal flesh of the chick and rolling the entire carcass in bone meal. The calcium content and phosphorus content are then increased to 2.9 percent and 1.6 percent, respectively, on a dry matter basis, and the Ca:P ratio is little altered.

Figures for day-old chicks in table 1 lend little credence to the possibility of thiamine deficiency in them when compared to figures for rats and chickens. Some breeders, in order to avoid the messiness of yolk on birds and equipment, may allow the chicks to live a day or two before killing them and thus deplete the yolk supply in their bodies. Since yolk is likely to be an excellent source of vitamin A and other nutrients, the practice is unwise, especially if chicks constitute a major part of the diet.

It has been suggested that feeding day-old chicks to breeding raptors may cause parent birds to mistake their young for food items (see transcript of 1971 Raptor Research Foundation, Inc., conference, Sioux Falls, South Dakota). More experimentation is needed to determine whether this problem exists. We have maintained a reasonably large colony of American Kestrels (*Falco sparverius*) on a diet of 90 percent day-old cockerels for three years and have yet to lose kestrel chicks for that reason. The size of the cockerel relative to the size of an adult kestrel may be important here.

Until the dietary requirements of birds of prey are more clearly defined by analysis of wild prey and/or controlled experimentation on captive birds, it is impossible to state whether or not the figures in table 1 represent adequate amounts in raptor diets. The larger hawks and falcons in our aviary seem to thrive on predominantly frozen-thawed whole rats with occasional feeds of whole chicken. Likewise, our kestrel colony is fed almost exclusively, year-round, on day-old cockerels supplemented during breeding time by bone meal and occasional doses of SA-37 vitamin additives (Rogar-STB Division of BTI Products, Inc., Pointe Claire, Quebec). These birds have not shown any serious poor performance in terms of either general health or reproduction.

In summary, it appears that the day-old chick compares reasonably well with other food species fed to captive raptors. However, calcium supplements may be required for growth and egg-laying. Although this partial analysis does not indicate any significantly low levels of the nutrients examined, with the possible exception of manganese, these results will be much more meaningful when dietary requirements of birds of prey are determined by further research.

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TABLE 1

PARTIAL ANALYSIS OF NUTRIENT LEVELS IN DOMESTIC RODENTS AND POULTRY

		Rats	Mice	Chickens	Day-old Chicks Strain 1	Day-old Chicks Strain 2
No. of animals		10	30	10	30	30
Average weight (g)		325.7	26.7	386.7	41.2	39.6
Dry matter percent (freeze dried)		34.4	35.4	33.5	27.6	26.4
Crude fat (percent DM*)		22.1	24.9	26.9	24.2	23.4
Crude protein (N x 6.25) (percent DM)		62.8	56.1	56.7	62.2	62.5
Ash (percent DM)		10.0	10.4	9.5	7.4	7.1
Crude fiber (percent DM)		2.4	1.7	2.0	0.8	1.1
Gross energy (kcal/g DM)		5.78	5.84	5.93	6.02	6.00
Calcium (percent)	DM:	2.06	2.38	1.94	1.36	1.24
	as fed:	0.69	0.84	0.65	0.38	0.33
Phosphorus (percent)	DM:	1.48	1.72	1.40	1.00	0.94
	as fed:	0.51	0.61	0.47	0.28	0.25
Ca:P ratio		1.39	1.38	1.39	1.36	1.32
Zinc (mg/kg)	DM:	129.2	134.6	158.0	106.9	136.4
	as fed:	43.3	47.7	52.8	29.9	36.3
Copper (mg/kg)	DM:	4.5	8.0	4.5	3.2	3.4
	as fed:	1.5	2.8	1.5	0.9	0.9
Manganese (mg/kg)	DM:	7.5	11.7	9.0	3.0	2.4
	as fed:	2.5	4.1	3.0	0.8	0.6
Iron (mg/kg)	DM:	175.7	239.1	146.8	121.8	120.1
	as fed:	58.9	84.6	49.1	34.0	31.9
Thiamine (mg/kg DM)		13.3	Not available	8.5	16.0	10.6

*DM = Dry matter

TABLE 2

RECOMMENDED* MINERAL AND THIAMINE REQUIREMENTS FOR THE DIETS OF GROWING AND BREEDING HENS

	Adult Chickens	Starting Chickens (0-8 weeks old)
Ca	2.75 percent of diet	
P	0.60 percent of diet	
Ca:P ratio	4.58	
Zinc	65 mg/kg diet	50 mg/kg
Copper	?	4 mg/kg
Manganese	33 mg/kg diet	55 mg/kg
Iron	?	80 mg/kg
Thiamine	0.8 mg/kg	

*By National Academy of Sciences, National Research Council

ABSTRACTS OF THESES AND DISSERTATIONS

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